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ECONOMIC GEOLOGY OF IOLA AND VICINITY.

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Read before the Academy, at Iola, December 31, 1901.

NO city in Kansas can display a greater variety of mineral interests than Iola. It is then very fitting that the first annual meeting of the Kansas scientists in the new century should be held in this center of industrial activity. Here may be seen one of the most complete cement plants west of the Mississippi, the largest number of zinc-smelting retorts in the United States, yielding one-half the total production of spelter in this country, the largest natural-gas engines constructed, probably the only sulphuric-acid works in the world where natural gas is used in reduction, and some of the model brick plants of the state. Here a quiet village of 1500 has changed in six years to a city of 8000, with a monthly pay-roll of \$100,000, the result of natural gas and the energy and hustle of competent and foresighted business men. Recently Iola has constructed an eighty-thousand-dollar water-works and electric-light plant. An electric railroad is now in operation, with cars running from the Neosho river, through Iola, to Gas City, Lanyonville, and La Harpe, representing an investment of \$150,000.

Outside of the mineral industries to be described, there are a number of important manufacturing plants at Iola, including the ice plant of the Iola Ice and Cold Storage Company, with a daily capacity of fifty tons, an iron foundry, a planing-mill, a creamery with a capacity of 1000 pounds a day, flour- and feed-mills, and a sawmill. These mills and factories alone would give Iola high rank as a manufacturing city, but they are overshadowed by the larger mineral industrial work.

NATURAL GAS.—The motive power for these various lines of manufacture is natural gas. Thirty years ago the Iola gas-sand was first pierced by the drill, in the old well, known to this day as the Acres mineral well, a sure cure for the ills of man. Its real value, however, was not recognized until the Ohio and Indiana gas was developed, in 1886; then the Iola Gas and Coal Company was organized and several wells were drilled, with poor success.

In 1889 Pryor and Paulin took charge of the work and drilled six additional wells, with about the same success; but near the end of 1893 a great flow of gas was struck, yielding three million cubic feet per day. In 1896 the company was changed, and became the Allen County Gas Company, and later, consolidated with the Cooperative Company,

formed the Iola Gas Company, which now supplies gas to the different parts of the city.

In 1894 the Palmer Oil and Gas Company, of Fostoria, Ohio, entered the field and leased about 45,000 acres. Their first well was drilled in August, 1894, and in the next three years they drilled fifteen wells, of which nine were productive, with a daily capacity varying from two to twelve million cubic feet, or a total of about fifty-eight million cubic feet, equivalent to nearly 3000 tons of coal. The holdings of this company in March, 1899, were transferred to the Lanyon Zinc Company, the gas-field still remaining under the able superintendence of L. C. Beatty, who came to Iola with the Palmer company. The company now has forty producing wells, yielding not far from 125 million cubic feet of gas per twenty-four hours, equal to 6200 tons of coal.

The Iola gas-field covers an area twelve by six miles, with over seventy producing wells. The first wells were drilled to a depth of 500 feet, while the later ones were sunk from 815 to 920 feet. The reservoir in the field is a porous sand, found in the Cherokee shales of the Lower Coal Measures, 20 to 150 feet in thickness. The rock pressure of the gas as measured by a gauge is 315 pounds to the square inch, or equivalent to twenty-one atmospheres, and this is the motive power which sends the gas out of the well and through the pipes. The open-flow pressure is about thirty-five pounds, and represents the volume. The Iola gas and the gas of the other districts in Kansas is remarkably pure, containing no sulphur or phosphorus, and can be used for any manufacturing purpose. The gas is supplied to the citizens at a cost of one dollar a month for each stove, and ten cents each for the first two lights and five cents for every additional light. It would be difficult to give the exact amount of gas used in twenty-four hours from the Iola field, but it certainly is not far from 12 million cubic feet, or equivalent to 600 tons of coal.

BRICK MANUFACTURE.—Natural gas furnishes a cheap and convenient fuel for burning brick, and Iola is surrounded by good brick shales. At the present time there are two companies, with three yards. Plant No. 1 of the Iola Brick Company is located one mile east of the center of town, and has a capacity of 40,000 brick daily. Their plant No. 2, just south of town, has a daily capacity of 60,000. Near the latter is the plant of the Star Brick Company, with a capacity of 25,000.

In southeastern Kansas, there are ten brick plants using natural-gas fuel, and three in the coal belt. All of these are running night and day, and cannot keep up with orders. New plants are being constructed, and in a short time Kansas will be well to the front rank as

a brick-producing state. The Iola brick-yards are equipped with the best of modern machinery, and manufacture building brick, dry pressed brick, repress brick, in pleasing and durable shades of color. They are shipped to Kansas City, Arkansas, Oklahoma, and various cities of Kansas.

ZINC SMELTERS.—For many years the zinc-smelting industry of the southern Mississippi valley centered in the Kansas coal district of Pittsburg and Girard. In 1896 a smelter was built at Iola by the Robt. Lanyon's Sons' Company, of Pittsburg; a thousand retorts were soon installed, and the experiment tried of using natural gas for fuel. The work was so successful that the smelters were removed to the gas belt, and new companies organized, so that the industry now centers at Iola and Cherryvale. Kansas has now become the leading zinc smelter state of the Union, going from second rank to first.

The process of treatment of the zinc ores is briefly as follows: After the sulphur is removed by roasting, the fine ore is placed in clay retorts, which are cylinders of fire-clay four feet long and eight inches in diameter, closed at one end. These fit in openings in the walls of the furnace, with the open ends flush with the walls, and are arranged in rows forming a block. When coal was used for fuel, 224 retorts were placed in a block, while with gas about 600 can be placed in one block. When charged with ore, a condenser, a conical fire-clay vessel, about twelve inches long and six inches in diameter at the larger end and two inches at the smaller end, is so placed that the larger end just enters the open end of the retort.

As the ore mixed with powdered coke is heated the zinc is driven off as heavy vapor, which forms in drops on the inside of the condenser, from which the metal is tapped in long ladles about three times in twenty-four hours. The molten metal is emptied into a traveling kettle and poured into molds about $9 \times 19 \times 1\frac{1}{4}$ inches, making a fifty-pound plate, known as "spelter."

The zinc-works make their own retorts and condensers, out of good fire-clay mixed with one-third its weight of fragments of old retorts pulverized. The materials are mixed in a pug-mill with water and then passed through a molding machine, and afterward dried in a heated room for some weeks. They are finally fired in a small furnace for twelve hours. The condensers are made in hand molds as needed.

At the present time, at Gas City there are three smelters—Prime Western, with three blocks or 2000 retorts; Cherokee-Lanyon, with three blocks; A. B. Cockerill, with three blocks.

At Lanyonville, the Lanyon Zinc Company has a smelter of five blocks and a zinc rolling-mill. At Iola is the Nicholson smelter of five blocks, the Wm. Lanyon smelter with three blocks, the two smelt-



Shale Pit of the Iola Brick Company, at Iola.

ers of the Lanyon Zinc Company of twelve blocks. This gives a total of about 20,000 retorts, giving a daily capacity of over 300 tons of spelter, requiring nearly 700 tons of ore.

SULPHURIC-ACID WORKS.—The new plant of the Standard Acid Company, now in active operation, is located just east of town. The zinc ore is roasted in mechanical continuous roasters composed of a seven-row muffle kiln, capable of roasting sufficient ore to run a three-block (1800 retorts) smelter. The sulphur fumes pass into a flue where the dust is deposited, and the sulphur gas passes to a square condensing tower, forty-nine feet high, and the heat of the gas is used to concentrate the weaker acid. The gas is then carried through a three-inch pipe into six chambers connected tandem, 150 feet long, 20 feet high and wide, and in these condensation takes place. Into these chambers exhaust steam is admitted, and the gas passes into two absorbing towers lined with lead and filled with a checkerwork of chemically prepared bricks, where the nitrogen compounds are recovered. These were added in the condensing tower in the form of nitric acid, to furnish oxygen.

In the lead-lined chambers the steam and sulphurous gas unite and form sulphuric acid. From the condensing towers the acid passes through lead coolers, kept cool by flow of water, and it is then pumped into storage tanks and run into tank cars of 65,000 pounds' capacity. Twenty of these cars have been constructed for this work.

The buildings cover twenty acres of ground. The main building is 526 feet long, 65 feet wide, with an L of 111 feet, and is 70 feet high. The plant will treat forty-five tons of ore a day, yielding fifty tons of acid. The acid will be used in the manufacture of fertilizers, refining of petroleum, alum, soda-ash, blue vitriol, etc. This is probably the only plant in the United States manufacturing sulphuric acid where natural gas is used as fuel. It is the second plant established in Kansas, the other being located at Argentine.

The sulphur vapors, so destructive to the vegetation around the smelters, are now to be made of economic importance, and, with the exhaust steam, furnish material which would otherwise go to waste.

POTLAND CEMENT.—The only Portland cement mill in the state is located at Iola, and it has now been in successful operation for two and a half years, turning out a quality of cement equal to the best foreign cement. Natural gas is the fuel used to drive the engine, to dry the material, and to burn the cement. The largest gas-engines in this section of the country are to be found at Iola. There are six 300-horse-power Westinghouse gas-engines and five 150-horse-power. The aggregate horse-power now used is 2600. About 1000 tons of

limestone are used in twenty-four hours, giving a daily production of 3500 barrels of cement.

Tests show a remarkable strength of product; neat briquettes have a strength of 800 to 1000 pounds after twenty-eight days, or with three parts sand have a strength of from 400 to 500 pounds, and ninety-five per cent. passes through a No. 100 sieve. This is brought about by careful manipulation and watching on the part of experts employed by the company. All mixtures are carefully examined, and tests are made at various stages of the manufacture, so as to secure a uniform product. The physical and chemical laboratories are thoroughly equipped, and three chemists are employed.

The mineral industries of Kansas must be seen to be appreciated, and, through the kindness of the citizens of Iola, the Kansas Academy of Science, composed of members interested in the scientific progress of the state, has been able to see a great industrial center and to become acquainted with the progress here shown. The members appreciate this opportunity, and will watch the growth of Iola in the future with new interest, and they will always carry a pleasant memory of the thirty-fourth meeting, at Iola.